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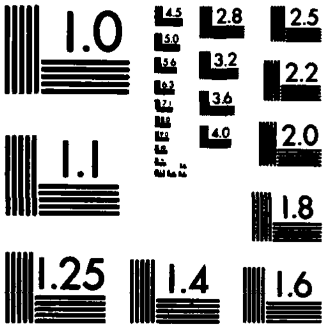
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USAFE Airbase Operations in a Wartime Environment

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USAFE AIRBASE OPERATIONS IN A WARTIME ENVIRONMENT

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ABSTRACT

This paper* describes assessments of the damage due to air attacks on USAFE air bases, and the impact of that damage on sortie production. These analyses also explore near-term changes in support concepts that would appear to offer possibilities for limiting some of the degrading effects of aircraft losses, battle damage, and air attack. These analyses form a portion of the ongoing policy investigations that are being conducted as a part of the Project AIR FORCE Resource Management Program at The Rand Corporation.

*This presentation was prepared for delivery at the Joint USAFE/AAFCE Operations Analysis Symposium on 19-21 October 1982 at Ramstein AB in West Germany. The analyses reported here, and the development of the TSAR and TSARINA simulation models that have been used for these analyses, have been supported by Headquarters USAF as a part of the Project AIR FORCE contract with The Rand Corporation.

INTRODUCTION

Recent dramatic improvements in Warsaw Pact offensive air capabilities seriously jeopardize NATO's strategic dependence on air support at the outset of a conventional war in Europe. Air power must not only withstand this new challenge of air attacks during the opening phase of a war, but must simultaneously support NATO ground forces in countering massive, concentrated Warsaw Pact ground operations. These well-recognized problems have led to a variety of programs intended to "toughen" airbases and to plans for generating large numbers of high sorties during the opening days of the conflict. Naturally, the "best" way to deal with air attacks is either to stop the attacks at their source, or to defeat them before they reach their targets. Although programs to improve NATO's airfield attack capabilities and active defenses do exist, the former face technical and budgetary problems and the latter, though they represent very substantial improvements, can be no more than a partial solution. For these reasons we have considered it important to look at the steps that might be taken to reduce the impact on airbase operations of air attacks, if they occur. To this end our work has emphasized (1) assessments of the damage that attacks might inflict, and the effects of such damage on sortie generation capabilities, and (2) examinations of the many different kinds of improvements that could be undertaken to reduce those effects.

The portion of that work that I will discuss in this presentation examines the problems expected during the critical opening days of a major conflict in Europe, and some possible changes in organization and procedures that could upgrade performance significantly in the near-term, before longer term solutions can be effected. The concepts that are examined here include rapid replacement of lost aircraft, early availability of battle damage repair personnel, and rapid identification and replacement of losses among maintenance personnel and equipment; we also examine a possible change in the wartime beddown of USAFE aircraft as a means of hedging against the near-term shortage of aircraft shelters.

Some of our results are not new, but others we feel are--at least in the sense that we have been able to quantify the importance of certain problems and the promise of certain responses. A key difficulty in making these kinds of assessments is the necessity to simultaneously examine the interactions and interdependencies among a wide range of factors. This difficulty has been overcome by using the TSAR/TSARINA models, developed by Rand for the Air Force.* These new computer tools simulate the numerous activities needed to launch effective combat sorties, permitting examination of the effect of airbase attacks on those activities at a complex of friendly airbases. The numerical results presented here have been developed with these models using detailed input data acquired from various Air Force sources.

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*Emerson, D., TSARINA--User's Guide to a Computer Model for Damage Assessment of Complex Airbase Targets, The Rand Corporation, N-1460-AF, July 1980.

Emerson, D., An Introduction to the TSAR Simulation Program: Model Features and Logic, The Rand Corporation, R-2584-AF, February 1982.

ANALYSIS

In the present analysis, we examine the (simulated) wartime activities of three USAFE units in the FRG--72 F-4Es at a main operating base (MOB) and two 24 F-4E squadrons that are to be deployed to COBs (colocated operating bases) when NATO forces are mobilized. Each base is resourced with the personnel, equipment, and spare parts normal for such bases; lateral supply and repair are supported by a responsive transportation system. Although the results are, of course, specific to this set of bases and resources, we feel that these bases are a reasonably representative slice of the theater, and that the results, at least in broad terms, will hold for the Central Region as a whole. For the first week of the war we directed these units to "surge" at rates of approximately two-and-a-half sorties per day. Aircraft were to be flown in groups of four [two minimum], during five 60-90 minute launch windows over a 14-hour flying day. This requirement was held constant throughout the analysis presented here.

If we assume, as planners frequently do, that losses will be instantly replaced, and that damaged aircraft do not affect sortie production, these objectives are largely fulfilled, as shown in Fig. 1. The upper line indicates the total numbers of sorties that the three bases might expect to achieve under these conditions. Although, as our analyses will indicate, we would not expect that performance to be representative of actual wartime operations, we will use it as a reference case in many of the results to be shown.

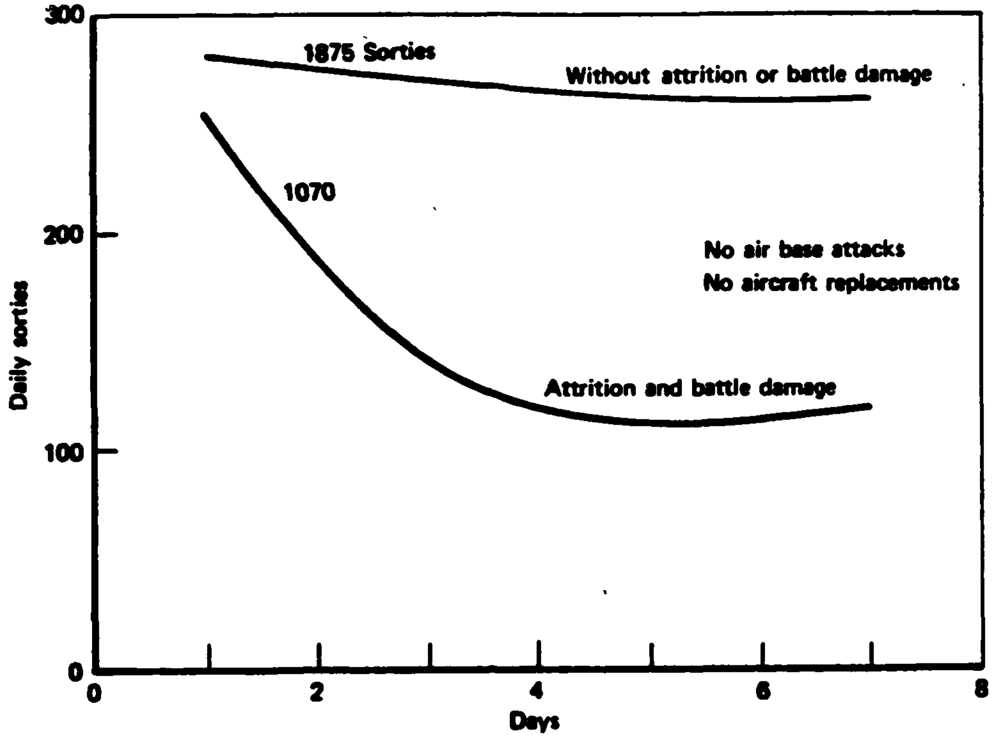

Fig. 1—Effect of attrition and battle damage on sortie generation

We next examined the same scenario, as it might actually develop during the first week in wartime, if replacements for lost or damaged aircraft could not be made available that soon. We assumed that the attrition rates for flight operations would drop-off as a function of time, and would average just under three percent per sortie during the first week. We assumed that the damage-to-kill ratio was 4:1, as was experienced in the South-East Asian (SEA) theater. (Manpower requirements for battle damage repair were also based on SEA experiences.) We found that there would be a very substantial reduction in the sorties, as the lower line in Fig. 1 indicates.

Figure 2 gives an indication of how this very serious shortfall occurred. As shown by the upper curve, there were substantial losses of

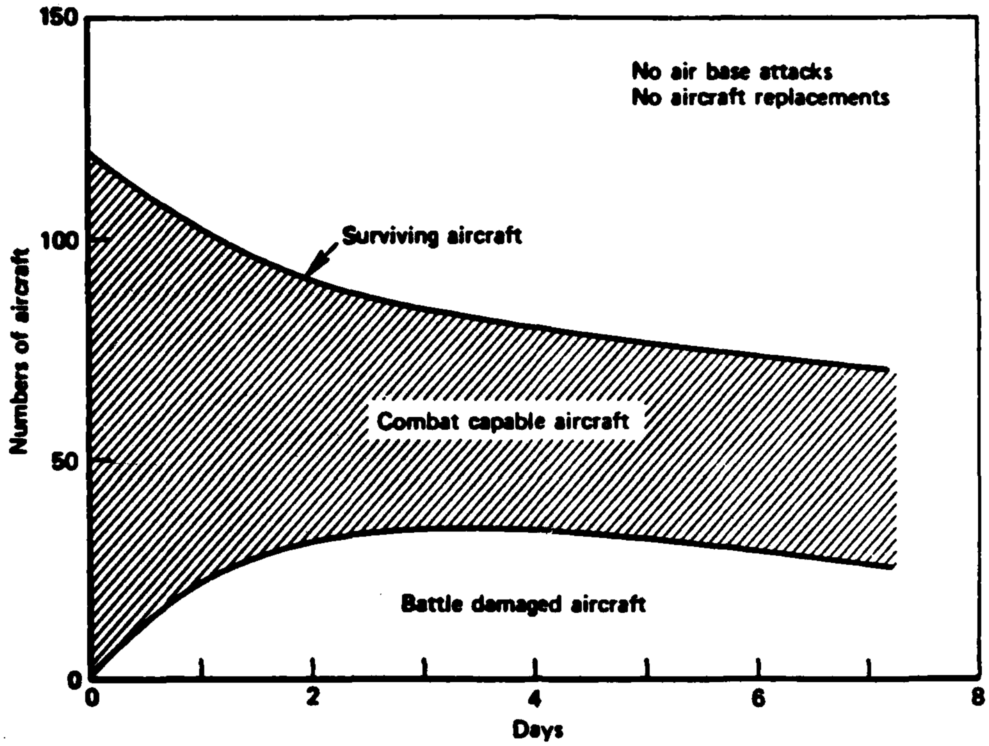

Fig. 2—Effect of attrition and battle damage on aircraft availability

aircraft. And as indicated by the lower curve, a large backlog of aircraft waiting for battle damage repair developed. The shaded region between the curves represents the limited force available to meet the scenario combat demands. To improve performance we need to replace lost aircraft (i.e., raise the upper curve) and to reduce the time required to repair damaged aircraft (lower the bottom curve).

In Fig. 3 we have assumed, first, that up to 72 aircraft are available as replacements within about two-and-one-half days of a loss. Performance is improved, but still falls far short of the reference case, as shown by the next to lowest curve.

Figure 3 also indicates the incremental improvement that might be achieved by having additional ABDR (aircraft battle damage repair)

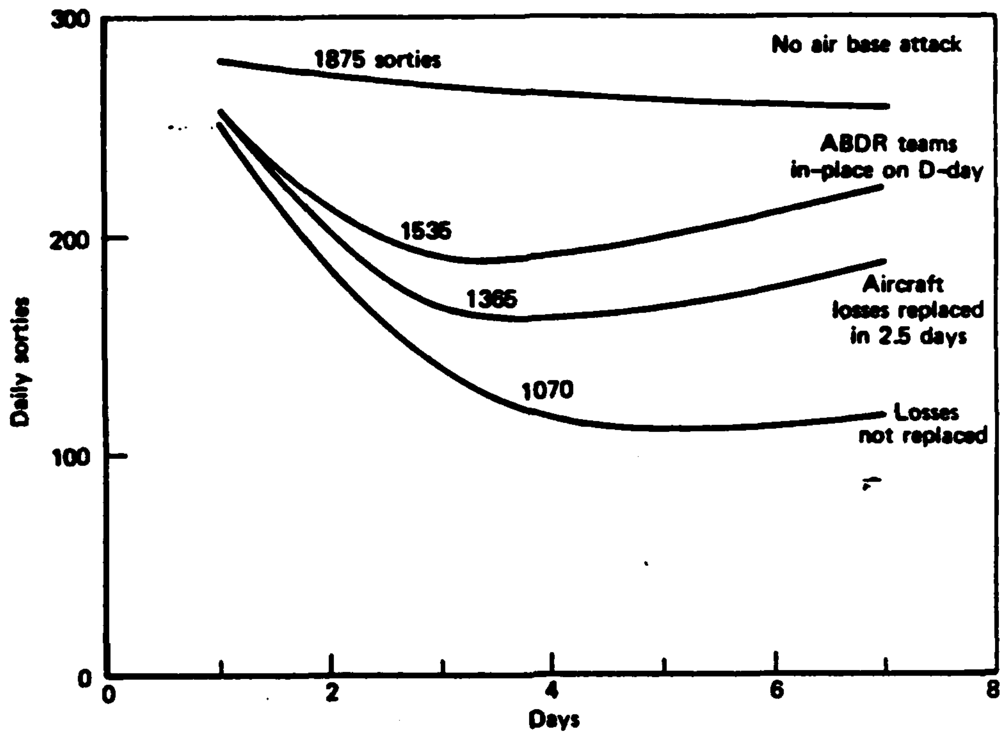

Fig. 3—Reducing effects of attrition and battle damage: aircraft replacement and extra ABDR personnel

specialists available on D-day (in addition to replacement aircraft). If, as presumed here, attrition and battle damage are highest at the beginning of the conflict, it is essential that battle damage specialists be in place by D-day. (Special spares kits, configured for battle damage, are also essential, and are presumed to be available.) But even when the specialists are in place at the beginning of the conflict, there is still a substantial sortie shortfall during the critical first week. Thus even in the absence of air attack, it seems unlikely that the planners' objectives for a "surge" can be attained because of the difficulty of maintaining a full complement of combat capable aircraft at the forward operating bases.

And what of air attack? Despite long-term Air Force efforts to obtain the funds needed to shelter all aircraft planned for deployment to the Central Region, the Congress has strongly resisted the necessary expenditures. Based on the programs that are currently funded, only about 60 percent of the USAF aircraft programmed to be in NATO's Central Region a week after M-day, can be sheltered (without crowding more than one aircraft into a shelter). No shelters will be available to USAFE on several of the COBs where early deployment is planned.

In our analyses of air attacks we assume that one of the two COBs does not have shelters but that the aircraft would be well dispersed on base. The attack levels examined are those that these three bases might expect if the Warsaw Pact were to initiate hostilities with an air campaign that stressed attacks on NATO's air assets, as it is frequently presumed that they would. The magnitude and schedules for these attacks are shown in Table 1. The attacks consist of third-generation fighter-bombers (F/B) and medium bombers (MB), delivering conventional munitions; chemical attacks and attacks with surface-to-surface missiles have not been considered. The Warsaw Pact Air Order of Battle, and the allocation of those forces to various NATO airbases, follows closely those that were developed recently in an earlier Rand study.

The air attacks we have examined presume that the enemy would concentrate on aircraft shelter areas and on the concentration of maintenance and support facilities. Our earlier analyses examined runways, as well as the shelter areas, as possible enemy targets, and

Table 1

ATTACK LEVELS FOR THREE-BASE USAFE COMPLEX

WARSAW PACT TARGET OBJECTIVE:
AIRCRAFT SHELTERS AND MAINTENANCE FACILITIES

WARSAW PACT AOB, ALLOCATION, AND EFFECTIVENESS
CONSISTENT WITH EARLIER RAND DAMAGE STUDY

	MOB		COB		COB	
	F/B	MB	F/B	MB	F/B	MB
DAY 1	32	8	32	10	28	6
DAY 3	32	8	16	4	19	4
DAY 5	32	8				
DAY 6			16	6	19	4

Warsaw Pact Attrition - 10% per Sortie

both types of attack would seriously affect USAFE operations; our present focus derives in part from the fact that many actions are already underway in the Air Force to counter the threat of runway attacks.

When lost aircraft are not replaced, and additional ABDR personnel are not in place at D-day, the sorties that would be generated despite the hypothetical Warsaw Pact airbase attacks are shown by the lowest line in Fig. 4. Only about one-third as many sorties are achieved, as in our reference case. The irregular generation profile is in large part due to the assumption that unscheduled maintenance is disrupted for six hours after heavy air attack; only aircraft launches and ongoing weapon loading and aircraft fueling tasks are accomplished during this period. The attacks destroy or damage over 50 aircraft, as well as

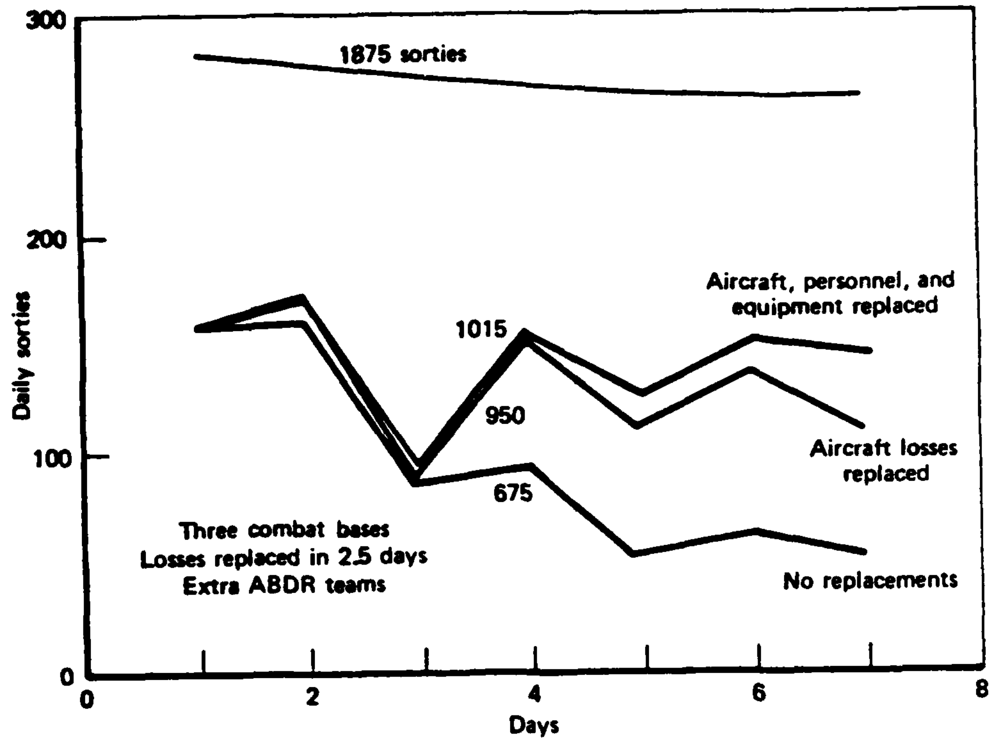

Fig. 4—Reducing effects of air base attacks: aircraft, personnel, and equipment replacement

substantial numbers of maintenance personnel, equipment, and spare parts.

If we now presume that replacement aircraft are available within two-and-one-half days, and that extra battle damage specialists are in place when the conflict begins, the force still is unable to achieve more than about 50 percent of the sorties flown in the reference case, as the next to the lowest in Fig. 4 indicates [the sorties flown equal about 50 percent of those expected when losses and damage are neglected].

Some sorties are prevented by the random losses among maintenance equipment and personnel; when these are also replaced within two-and-one-half days of their loss, performance is improved somewhat as is also shown in Fig. 4, but not very much. The critical problem is airframes. During this first week an average of only about 75 aircraft are available to respond to the demand for sorties, despite the introduction of substantial numbers of replacement aircraft.

What can be done to improve matters? If we accept attrition and battle damage as facts of life, and if we accept that airbase attacks are likely, then we must look for improvements in our defenses and for more and better use of our resources. Better management of resources was implied, of course, when the capability to identify and replace losses in only two-and-one-half days was discussed. What is needed is a way to maintain more mission capable aircraft at forward bases throughout the conflict. Since aircraft based forward are better able to lend effective support than those that are based well to the rear, in the U.K. for example, why not plan to rotate "battle-weary" aircraft to the rear and to quickly replace them with "fresh" aircraft. Although these "battle-weary" aircraft that would be returned to the rear could also be subjected to air attack, the Pact has substantially less capability for attacks at that range, and a rearward maintenance base would be a relatively unattractive target, if not assigned large numbers of aircraft.

To examine this possibility, we have assumed that the unit formerly destined for the unsheltered COB is deployed instead to the U.K., but that the unit's aircraft and many of the personnel needed to quick-turn the aircraft are assigned to the two forward bases. In this case, at war's outbreak there are 90 aircraft at the MOB (with 72 shelters) and 30 at the sheltered COB. We also assume that whenever damage or unscheduled maintenance are projected to require more than six hours maintenance, that the aircraft is flown to the rear as soon as it can be readied for a ferry flight.* (In this examination it is assumed that no attrition is sustained on ferry flights, and that the rear base is not subjected to air attack.) When the work in the rear is complete, the aircraft is returned to its operating base if shelters are available; no credit is taken for these flights in our sortie results. If the aircraft cannot be accommodated at the forward base, it is maintained on a sufficient alert to replace a "battle-weary" aircraft with an hour's notice.

Although such a reorganization of our forces may offer a hedge against the lack of aircraft shelters, the question arises as to how serious a penalty would be imposed by this mode of operation if air bases were not attacked. As shown in Fig. 5, operations from two forward bases are nearly as effective as from three, even in the absence of airbase attack; the two bases deliver 95 percent as many sorties as the three bases.

Figure 6 shows the performance of these reorganized forces when there are attacks. There has been only a slight improvement; the two-base configuration delivers only three percent more sorties during the first critical week. However, there are 34 percent more aircraft available at the end of the first week because 31 fewer losses have been sustained. Both sorties and surviving aircraft would therefore be increased by this hypothetical reorganization of U.S. air operations in

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*For this preliminary examination of this mode of operation, it has been assumed that battle damage aircraft can be ferried. However, on many occasions, there are other unscheduled maintenance tasks which must be accomplished before the aircraft may be ferried. The actual algorithm used in TSAR to identify aircraft to be sent to the rear does not schedule a ferry flight for aircraft when a substantial portion of the required maintenance must be accomplished at the forward base before the aircraft can be ferried.

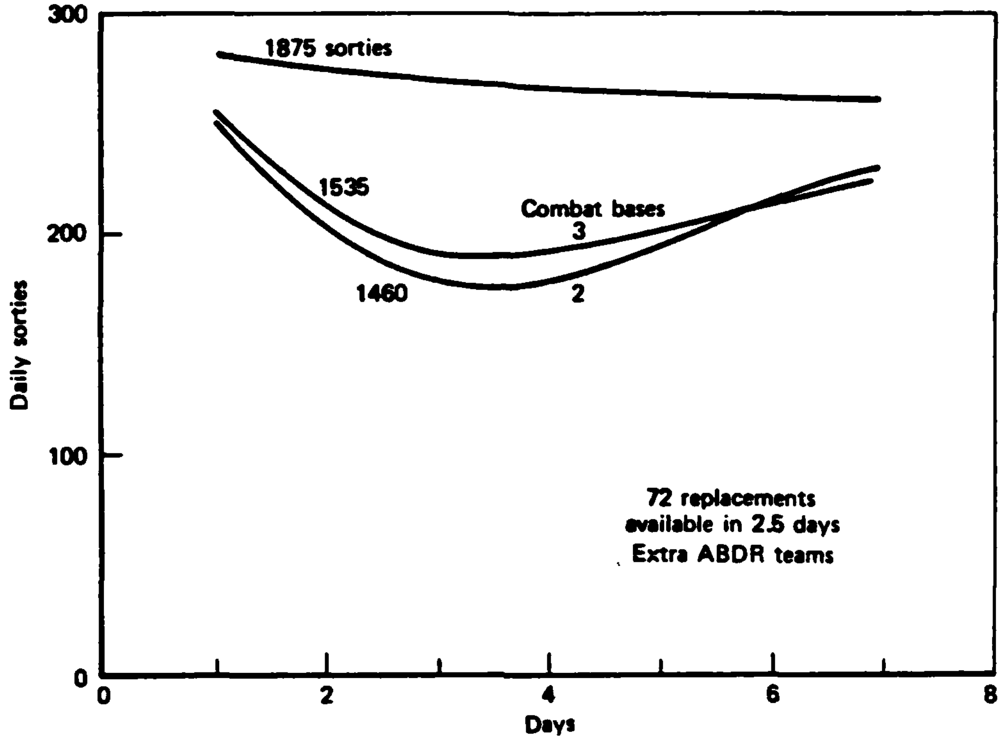

Fig. 5—Surge capabilities of a two-base and a three-base posture, no air base attacks

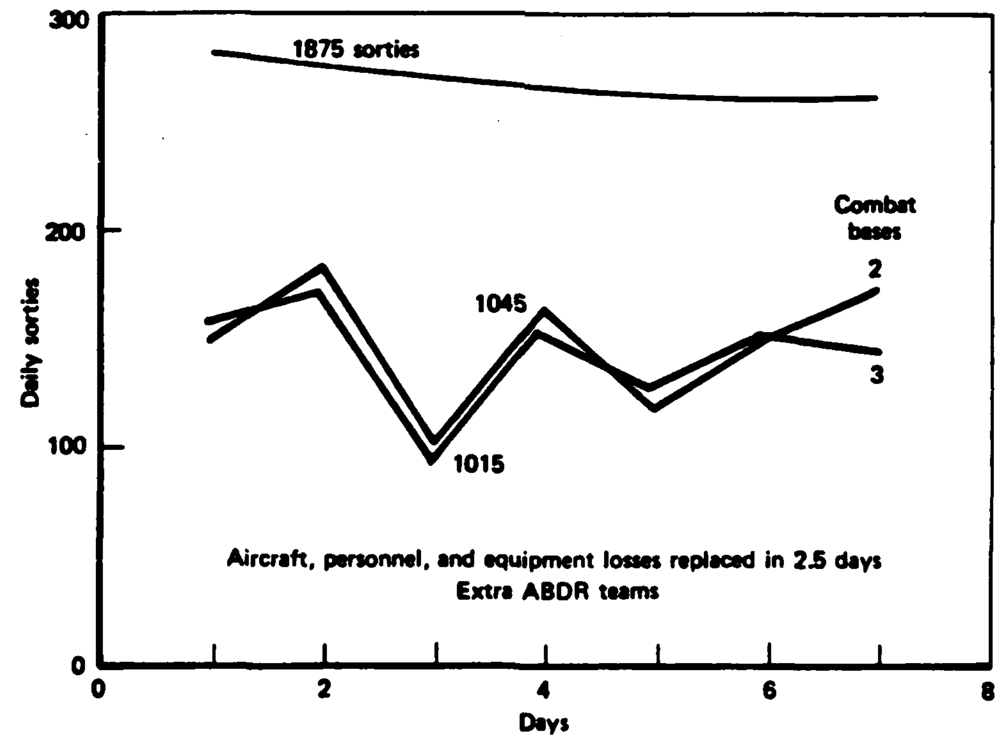

Fig. 6—Surge capabilities of a two-base and a three-base posture with air base attacks

the Central Region; nevertheless, the sorties delivered during the first week are still only a fraction of the performance achieved in the reference case.

In either of these modes, the maintenance resources available at the forward bases are sufficient to support greater numbers of combat capable aircraft. In Figs. 7 and 8 we have presumed that rather than waiting for two-and-one-half days to acquire a replacement aircraft (as we have assumed might be achievable under current plans), that they could be made available almost immediately if a portion were to be maintained by the "COB resources" already assigned to the U.K. in the two-base configuration.

In the absence of airbase attack, this forward-rear organization generates over 93 percent as many sorties as are produced in the reference case, and even when the forward bases are attacked (Fig. 8), they still generate 65 percent as many sorties. Furthermore, except for redistributing spare parts (and some maintenance personnel) in a manner consistent with where maintenance is performed, the two-base posture does <u>not</u> reduce the self-sufficiency of the combat units; indeed, they have been <u>strengthened</u> for their combat role.

If we compare the two-base configuration using rapid replacements to the three-base operation, we find that the sorties flown during the first week have been increased by 14 percent in the absence of airbase attack, and by 20 percent when there are airbase attacks. Furthermore, there are about 12 percent more aircraft available at the end of the first week.

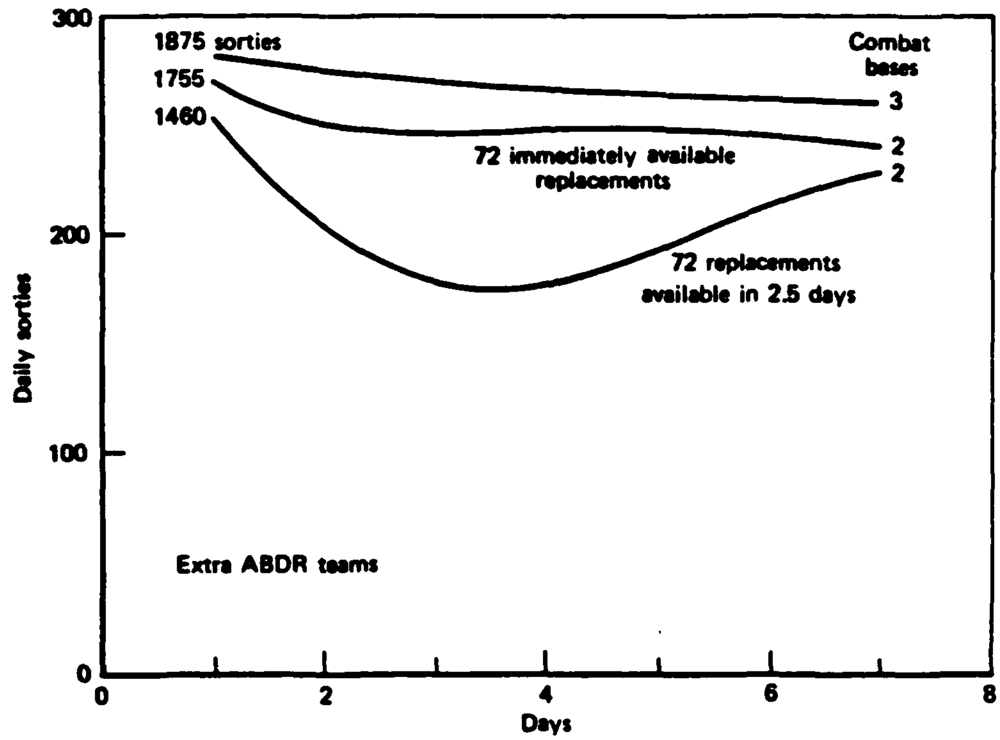

Fig. 7—Two base sortie generation with rapid replacements, no air base attack

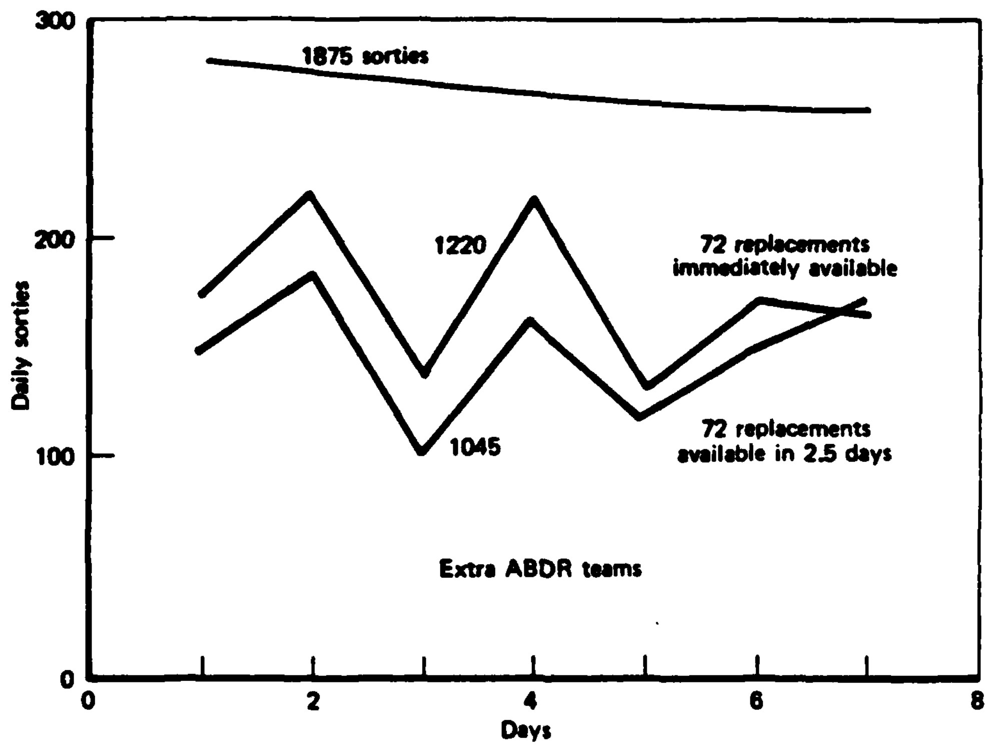

Fig. 8—Two base sortie generation with rapid replacements, with air base attacks

Table 2 summarizes all the results discussed. The sorties generated under various conditions during the first week are listed in the second and third columns, and the aircraft surviving at the end of the week are shown in the columns to the right. As can be seen, each of the modifications--timely aircraft replacement, early availability of additional ABDR personnel, and rapid identification and replacement of losses among maintenance personnel and equipment--offers substantial benefits. When combined with the use of the COB resources at a rear-area base to hedge against shelter limitations and to handle battle damage and other extended maintenance, we find that sortie generation

Table 2

STATUS AFTER SEVEN DAYS COMBAT

		FILLERS AVAILABLE	TOTAL SORTIES		SURVIVING AIRCRAFT			
					At Forward Bases		Total	
			No ABA	ABA	No ABA	ABA	No ABA	ABA
PEACETIME ENVIRONMENT								
	No Attrition or Battle Damage	---	1875	---	120	---	---	---
WARTIME ENVIRONMENT								
THREE COMBAT BASES	No Aircraft Losses Replaced	---	1070	675	73	42	---	---
	Losses Replaced in 2.5 Days	72	1365	---	135	---	135	---
	+ ABDR Teams in Place	72	1535	950	134	94	135	95
	+ Personnel/Equipment Losses Replaced	72	na	1015	na	90	na	92
TWO COMBAT BASES	Losses Replaced in 2.5 Days + ABDR Teams in Place	72	1460	1045	129	84	129	123
	+ Rapid Replacement of Aircraft Losses	72	1750	1220	122	80	122	104

has been increased by 60 percent in the absence of air attack, and by 80 percent if our bases are attacked, when compared to that without any of the changes.

Even though these achievements fall short of the reference case by six percent and 35 percent, respectively, there have been impressive gains. These changes have made it possible to sustain the combat force at the forward bases reasonably well by virtue of the ready availability of "filler" aircraft; and, in the event of air attack, substantially fewer aircraft are lost since aircraft shelters are available for the aircraft in the forward area. A large proportion of the aircraft that require maintenance are located at the base in the rear where there is less risk of air attack.